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Studies on Diversity of Freshwater Crabs (Decapoda: Brachyura: Gecarcinucidae) Collected from in and Around Paddy Field of Kancheepuram District, Tamil Nadu.

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Abstract: Freshwater ecosystem has an endemic flora and fauna including freshwater crabs. They are ecologically and medically essential macro-inbertebrates. As literature on diversity, richness, abundance and evenness of freshwater Brachyuran crabs are very meagre the present study was undertaken. Over the course of a year freshwater crabs were collected from the paddy field of Kancheepuram district by various methods based on the ecosystem and the collected specimens were preserved for future studies. The diversity of fresh water crab from the paddy field of Kancheepuram was studied. The study revealed that the Gecarcinucidae crab *Oziotelphusa biloba* was the most predominant species which is followed by *Oziotelphusa bouvieri*. Maximum population density of the crabs was recorded during last month of the year and the minimum was recorded during the fifth month of the year.

Key Words: Freshwater Crab, Diversity, Richness, Evenness, Paddy Field.

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Introduction

Fresh water crabs are fascinating crustaceans that inhabit a wide range of aquatic ecosystem, from rivers, streams, lakes and wetlands. Despite their importance in thus ecosystems, fresh water crabs often remain under studied. These crabs play crucial roles in nutrient cycling, food webs and as indicators of environmental health with thousands of species spread across various families, the biodiversity of fresh water crabs is rich and varied reflecting adaptations to diverse habitats worldwide.

Currently there are approximately 6,800 valid species of brachyuran crabs and about 1,300 (19.4%) of these have been reported from freshwater habitat (Ng *et al*., 2008; Yeo *et al*., 2008)

They inhabit tropical and sub – tropical regions worldwide, with over 1,300 species spread across eight families.While specific data on Indian freshwater crabs species is limited, Asia is home to diverse species, particularly in the families Potamidae and Gercarcinucidae.
So, the present work was undertaken to study the diversity, richness and eveness of the Gercarcinucidae crabs in Kanchipuram district.

Materials and Methods

In the present study the animals were obtained between January 2024 throuh December 2024. In Kanchipuram district of Tamil Nadu, paddy is primarily cultivated during the Adipattam (June-Aug), corresponding to the South West Monsoon, and the Purattasi pattam (Sep-Nov), also known as the North East Monsoon season. The district successfully grows paddy in two consecutive seasons, utilizing the rainwater stored in tanks from the North East Monsoon, which brings significant rainfall. The district lies in between 12º, 10′ and 13º 15′ N and 79º 15′ and 80º 2′ E. Temperature ranges from 36.6ºC to 21.1ºC; the average annual rain fall in most of the places of the district is around 1200 millimeters. The freshwater crabs were collected with the help of hand picking methods. Freshwater crab adult samples were collected in the Morning and evening in paddy fields and placed them, as far as possible, in separate plastic bags or vials. During collection the "pregnant female and juveniles" were released back into the same field for conservation purpose. In the laboratory, crabs were removed fom the each sample; they were preserved in 70% alcohol. Few specimens were deposited in ZSI Pune, for confirmation of identification of specimen. Little Formalin should not be used for long periods since it tends to harden all the connective tissue making future manipulation difficult.

Ecological Indices

Univariate ecological diversity indices, was assessed using (Shannon-Wiener H'), Richness (Margalef's d), Dominance (Simpson's 1-λ) and Evenness (Pielou's J) were calculated based on $\log_2$. All the indices calculations were done using the software PRIMER 5 (Plymouth Routine In Multivariate Ecological Research) (Clarke *et al*., 2001). Following formulae were used for calculating the indices: Diversity index (Shannon-Wiener) - [$H' = -$ Sum ($p_i * \log_2 (p_i)$] (Shannon and Weaver, 1949).

Result and Discussion

In the present study fresh water Brachyuran crabs were collected for a period of one year (January 2024 – December 2024) from the paddy fields of Kanchipuram district. The collected specimen were identified and they fall under there genera namely *Oziotelphura*, *Barytelphura* and *Spiralotelphura* and 6 species from *Oziotelphura*, 2 species from *Barytelphura* and 3 species from *Spiralotelphura* were recorded. They were as follows *Oziotelphura bouvieri Oziotelphusa biloba*, *Oziotelphusa naga*, *Oziotelphusa aurantia*, *Oziotelphusa stricta*, *Oziotelphusa ceylonensis*, *Barytelphusa cunicularis*, *Barytelphusa guerini*, *Spiralothelphusa wuellerstorfi*, *Spiralothelphusa senex*, *Spiralothelphusa senex*, *Spiralothelphusa gibberosa.*

Population density: The population density of Brachyuran freshwater crabs was observed from the study area. The monthly variation of population density varied from almost 2 individuals to 280 individuals. The maximum was observed in December and minimum was observed in May during the study period. The species variation of population density varied from 211 individuals to 1160 individuals.

According to Fig. 1, the maximum population density was shown by *Oziotelphusa biloba* and considered to be the dominant species and the minimum population density was shown by *Oziotelphusa naga*.

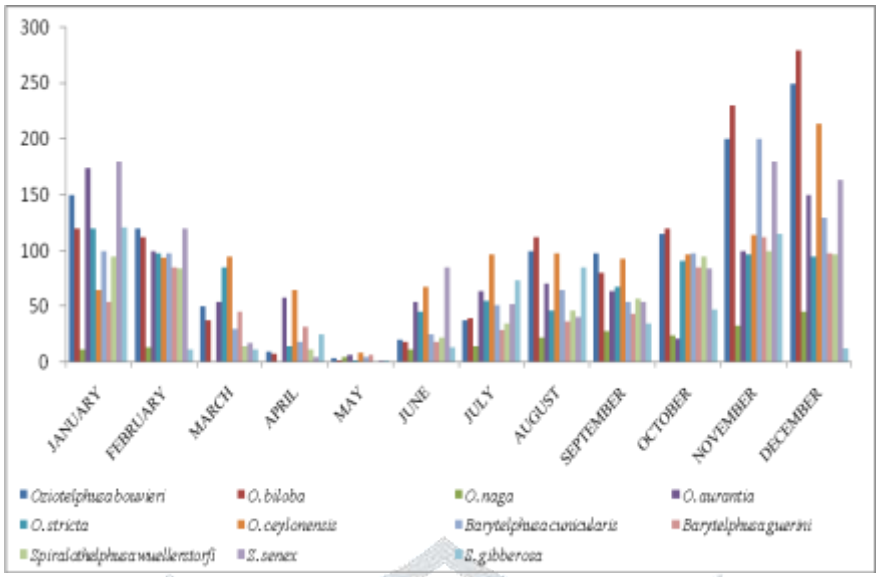


Fig.1. population density of brachyuran freshwater crabs

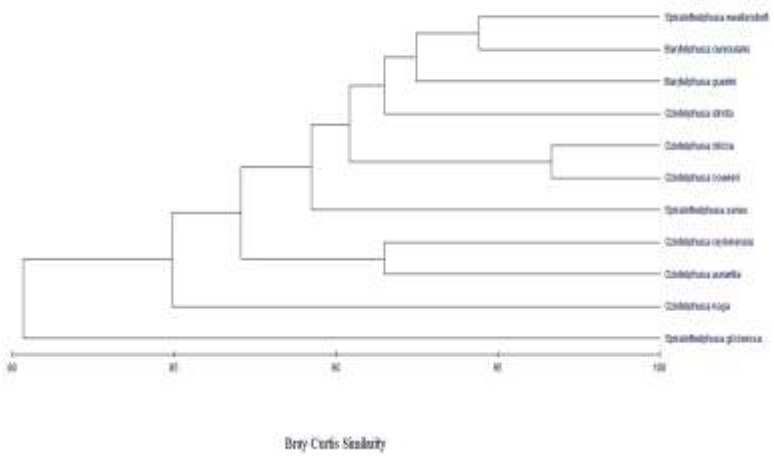
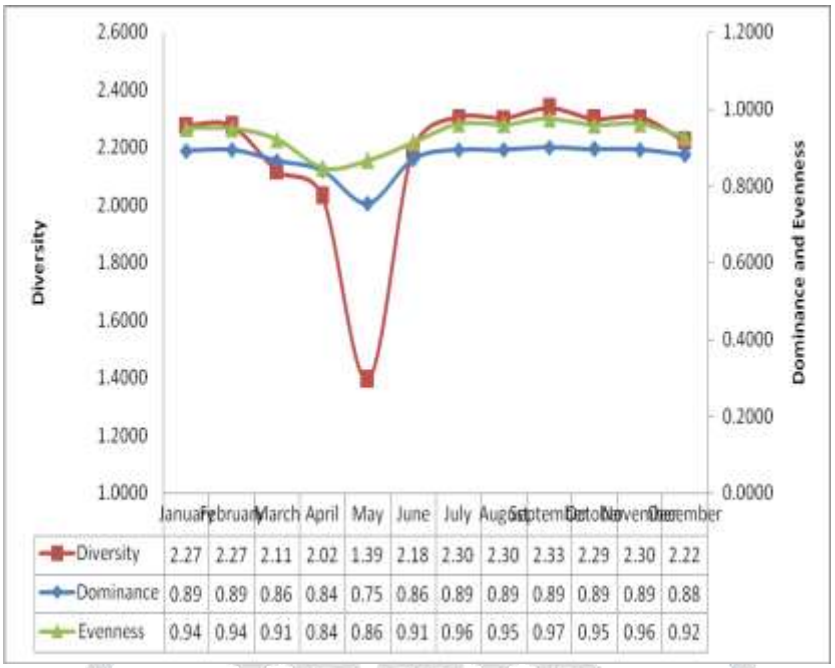


Fig.2. cluster analysis of brachyuran crabs found in different months of kancheepuram district.

The analysis gave a clear pattern highlighting the similarities in diversity during the study period. The maximum likely hood tree of combined 80%. The minimum similarity of 92% cluster analysis shows the presence of groups of species in a parallel manner across month. The Bray – Curtis cluster analysis diagram shows the diversity of brachyuran crabs about 90% are collected during the months and its similarity of collected species (Fig.2).



	January	February	March	April	May	June	July	August	September	October	November	December
Diversity	2.27	2.27	2.11	2.02	1.39	2.18	2.30	2.30	2.33	2.29	2.30	2.22
Dominance	0.89	0.89	0.86	0.84	0.75	0.86	0.89	0.89	0.89	0.89	0.89	0.88
Evenness	0.94	0.94	0.91	0.84	0.86	0.91	0.96	0.95	0.97	0.95	0.96	0.92

Fig.3. ecological indices (dominance, diversity and evenness) of fresh water crabs.

Richness

The number of taxa (5) remained relatively constant at 10 or 11 for most of the year. However, a significant drop was observed in May where only 5 taxa were recorded. Margalefs richness index (d), which accounts for both the number of species and total abundance, reflected this trend but provided additional nuance. The highest richness was surprisingly recorded is April (d = 1.81), despite a low total abundance (N = 249), indicating a well – distributed, species – rich sample for its size. The lowest Margalef's value was in May (d=1.26), consistent with the low S and N (Fig.3).

Total abundance (N)

Total abundance showed strong seasonal fluctuation. The lowest abundance was recorded in May (N= 24) followed by April (N=249). The highest abundance were observed in the later months, peaking is December (N=1536) and November (N=1481).

Diversity Indians

The shennon – Wiener index (H) and Simpson's dominance index (1- λ) showed parallel trends. The highest diversity was observed in September (H – 2.34, λ = 0.90), followed closely by July, August and November. The lowest diversity was unequivocally recorded in May (H= 1.39, 1- λ- 0.75), significantly lower than all other months. Diversity was also relatively lower in April (H = 2.03) and March (H = 2.12) (Fig.3).

Evenness

Piclou's evenness index (J) was generally high (> 0.91) for most of the year, indicating that individuals were distributed evenly among the present taxa. The highest evenness was found in September (J = 0.97). The lowest evenness was recorded in April (J = 0.85), suggesting that despite having 11 taxa, the community was dominated by a few species. Evenness in May was also relatively low. (J = 0.87) (Fig.3). The observed temporal variations in biodiversity indices are consistent with known seasonal dynamics in aquatic ecosystems and can be interpreted through the lens of established ecological principles and past research.

In the present study the profound collapse in all ecological metrics in May is characteristics of an acute environmental disturbance. Such a sharp decline in total abundance (N=24), species richness (S=5) and diversity (H^1=1.39) may be due to natural seasonal succession alone often points to a punctuate stress events. In riverine systems, similar crashes have been strongly linked to toxic pollution events which can cause mass mortality of sensitive macro invertebrate taxa (Beketova *et al*., 2013). Alternatively a several spate events can cause drastic physical scouring of the river substrate, removing organisms and result in the community to an early successional stage (Death, 2010; Lake 2000).

This disturbance hypothesis'' is supported by the subsequent recovery showing the community resilience. The low evenness (J = 0.87) in May suggest that the few taxa that remained or first recolonized were highly tolerant, opportunistic species, a common pattern following a disturbance.

The community state in April presents an ecological paradox: high richness (S = 11, d = 1.81) coupled with low evenness (J = 0.858) and abundance. This pattern is indicative of a transitional or recovery phase. Following a smaller, unrecorded disturbance prior to April, opportunistic and highly mobile "r – strategist" species after colonize habitat first and achieve high dominance, explaining the low evenness. Distinguishing stressors that can be directly controlled from those over which managers have no direct control, such as climate change will also be critical (Verdonschot *et al*. 2013), especially since climate change is changing ecological baselines (Duarte *et al*. 2015).

The high richness value may be inflated by the presence of these early colonists alongside a few remaing resistant individuals from the previous community all within a low total abundance. This aligns with the intermediate disturbance hypothesis, which posits that diversity can be highest at intermediate levels of disturbance due to the co – existence of opportunistic and competitive species (Wilkinson, 1999). April may represent this intermediate point between the disturbance and the stable summer community.

The peak in diversity, evenness and stability from July through November represents the period of optimal environmental conditions for the macro invertebrate community. High and consistent values for Shannon (H) and Simpson (I - λ) indices, alongside near – perfect evenness (J = 0.97 in September) indicate a well balanced community where no single species dominates and resources are partitioned effectively. This is a classic signature of a climax community under stable environmental conditions (Odum, 1969). During these months, factors such as stable flow regions, optimal water temperature, and high primary productivity likely facilitate high niche availability and minimal stress, allowing for the co – existence of a large number of species in eqitable abundances (Allan and Castillo, 2007). This high total abundance in Nov – Dec is common, often driven by the growth of populations of tolerant species like chironomids or oligochates as temperature cool and predators become less active.

Summary

In summary in the present study the data reveals a community experiencing a predictable cycle of seasonal variation punctuated by a significant anomalous disturbance in May. The recovery following May demonstrates the ecosystems resillience, but the severity of the crash highlights its vulnerability.

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